

## Claim Or Claims

- 1) A method for reducing NO<sub>x</sub> in a gas stream comprising the steps of sequentially exposing said gas stream to a first catalyst and a second catalyst wherein said first catalyst:
  - 5 a. converts at least a portion of said gas stream to a reducing gas,
  - b. reduces at least a portion of said NO<sub>x</sub> in a first temperature range, and
  - c. absorbs at least a portion of said NO<sub>x</sub> in said first temperature range, and wherein said second catalyst
  - 10 d. reduces at least a portion of said NO<sub>x</sub> in a second temperature range utilizing said reducing gas.
- 2) The method of claim 1 wherein said reducing gas is selected as a partially oxidized hydrocarbon.
- 3) The method of claim 1 wherein said reducing gas is selected as an aldehyde.
- 4) The method of claim 3 wherein said aldehyde is selected from the group  
15 consisting of acetaldehyde and formaldehyde.
- 5) The method of claim 1 wherein said gas stream is exposed to a plasma prior to the step of exposing said gas stream to said first catalyst.
- 6) The method of claim 1 wherein said gas stream is exposed to a plasma simultaneous with the step of exposing said gas stream to said first catalyst.
- 20 7) The method of claim 1 wherein said gas stream is exposed to a plasma simultaneous with the step of exposing said gas stream to said second catalyst.
- 8) The method of claim 1 wherein said gas stream is exposed to a plasma simultaneous with the steps of exposing said gas stream to said first catalyst and said second catalyst.
- 25 9) The method of claim 1 wherein said first catalyst is selected as a zeolite.

- 10) The method of claim 9 wherein said first catalyst is selected as a zeolite impregnated with an cation.
- 11) The method of claim 10 wherein said cation is selected from the group consisting of an alkaline cation, an alkaline earth cation, and combinations thereof.
- 12) The method of claim 1 wherein said first catalyst exhibits pores sizes of greater than 4 angstroms.
- 13) The method of claim 1 wherein said first catalyst exhibits pores sizes of greater than 7 angstroms.
- 14) The method of claim 1 wherein said first catalyst is selected as barium/zeolite Y (BaZY).
- 15) The method of claim 1 wherein said first catalyst is selected as barium/zeolite Y (BaZY) prepared via solution ion exchange of  $\text{Ba}^{2+}$  on sodium/zeolite Y (NaZY).
- 16) The method of claim 1 wherein said second catalyst is selected as a  $\gamma$ -alumina catalyst.
- 17) The method of claim 16 wherein said  $\gamma$ -alumina catalyst is impregnated with ions selected from the group consisting of transition metals.
- 18) The method of claim 17 wherein said transition metal is selected from the group consisting of Ag, In and Sn.
- 19) The method of claim 1 wherein said second catalyst is selected as Ag/ $\gamma$ -alumina catalyst doped with between 8 and 0.1 wt% Ag on  $\gamma\text{-Al}_2\text{O}_3$ .
- 20) The method of claim 1 wherein said second catalyst is selected as Ag/ $\gamma$ -alumina catalyst doped with between 3 and 0.5 wt% Ag on  $\gamma\text{-Al}_2\text{O}_3$ .

- 21) A method for reducing NO<sub>x</sub> in a gas stream comprising the steps of sequentially exposing said gas stream to a first catalyst and a second catalyst wherein said first catalyst:
- a. converts at least a portion of said gas stream to a reducing gas,
  - 5 b. reduces at least a portion of said NO<sub>x</sub> in a first temperature range of up to about 500 degrees K, and
  - c. absorbs at least a portion of said NO<sub>x</sub> in said first temperature range, and wherein said second catalyst
  - 10 d. reduces at least a portion of said NO<sub>x</sub> in a second temperature range of between about 450 degrees K to about 800 degrees K utilizing said reducing gas.
- 22) The method of claim 21 wherein said reducing gas is selected as a partially oxidized hydrocarbon.
- 23) The method of claim 21 wherein said reducing gas is selected as an aldehyde.
- 15 24) The method of claim 23 wherein said aldehyde is selected from the group consisting of acetaldehyde and formaldehyde.
- 25) The method of claim 21 wherein said gas stream is exposed to a plasma prior to the step of exposing said gas stream to said first catalyst.
- 20 26) The method of claim 21 wherein said gas stream is exposed to a plasma simultaneous with the step of exposing said gas stream to said first catalyst.
- 27) The method of claim 21 wherein said gas stream is exposed to a plasma simultaneous with the step of exposing said gas stream to said second catalyst.
- 28) The method of claim 21 wherein said gas stream is exposed to a plasma simultaneous with the steps of exposing said gas stream to said first catalyst and said second catalyst.
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- 29) The method of claim 21 wherein said first catalyst is selected as a zeolite.
- 30) The method of claim 29 wherein said first catalyst is selected as a zeolite impregnated with an cation.
- 5 31) The method of claim 30 wherein said cation is selected from the group consisting of an alkaline cation, an alkaline earth cation, and combinations thereof.
- 32) The method of claim 21 wherein said first catalyst exhibits pores sizes of greater than 4 angstroms.
- 10 33) The method of claim 21 wherein said first catalyst exhibits pores sizes of greater than 7 angstroms.
- 34) The method of claim 21 wherein said first catalyst is selected as barium/zeolite Y (BaZY).
- 15 35) The method of claim 21 wherein said first catalyst is selected as barium/zeolite Y (BaZY) prepared via solution ion exchange of  $\text{Ba}^{2+}$  on sodium/zeolite Y (NaZY).
- 36) The method of claim 21 wherein said second catalyst is selected as a  $\gamma$ -alumina catalyst.
- 37) The method of claim 36 wherein said  $\gamma$ -alumina catalyst is impregnated with ions selected from the group consisting of transition metals.
- 20 38) The method of claim 37 wherein said transition metal is selected from the group consisting of Ag, In and Sn.
- 39) The method of claim 21 wherein said second catalyst is selected as Ag/ $\gamma$ -alumina catalyst doped with between 8 and 0.1 wt% Ag on  $\gamma\text{-Al}_2\text{O}_3$ .
- 25 40) The method of claim 21 wherein said second catalyst is selected as Ag/ $\gamma$ -alumina catalyst doped with between 3 and 0.5 wt% Ag on  $\gamma\text{-Al}_2\text{O}_3$ .

- 41) A method for reducing NO<sub>x</sub> in a gas stream comprising the steps of sequentially exposing said gas stream to a first catalyst consisting of barium/zeolite Y (BaZY) having pores sizes of greater than 7 angstroms and a second catalyst consisting of Ag/γ-alumina catalyst doped with between 3 and 0.5 wt% Ag on γ-Al<sub>2</sub>O<sub>3</sub> wherein said first catalyst:
- a. converts at least a portion of said gas stream to a reducing gas,
  - b. reduces at least a portion of said NO<sub>x</sub> in a first temperature range, and
  - c. absorbs at least a portion of said NO<sub>x</sub> in said first temperature range, and wherein said second catalyst
  - d. reduces at least a portion of said NO<sub>x</sub> in a second temperature range utilizing said reducing gas.
- 42) The method of claim 41 wherein said reducing gas is selected as a partially oxidized hydrocarbon.
- 43) The method of claim 41 wherein said reducing gas is selected as an aldehyde.
- 44) The method of claim 43 wherein said aldehyde is selected from the group consisting of acetaldehyde and formaldehyde.
- 45) The method of claim 41 wherein said gas stream is exposed to a plasma prior to the step of exposing said gas stream to said first catalyst.
- 46) The method of claim 41 wherein said gas stream is exposed to a plasma simultaneous with the step of exposing said gas stream to said first catalyst.
- 47) The method of claim 41 wherein said gas stream is exposed to a plasma simultaneous with the step of exposing said gas stream to said second catalyst.
- 48) The method of claim 41 wherein said gas stream is exposed to a plasma simultaneous with the steps of exposing said gas stream to said first catalyst and said second catalyst.

- 49) The method of claim 41 wherein said first catalyst is selected as barium/zeolite Y (BaZY) prepared via solution ion exchange of Ba<sup>2+</sup> on sodium/zeolite Y (NaZY).